A Wet Plate Cookbook

An Honors Thesis (HONR 499)

by

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Abstract

Wet plate photography is almost 200 years old, yet despite that age the process is still extremely variable and clear directions with results are hard to find. The goal is use my education in chemistry to refine and understand the variability of wet plate photography. For this project, I will be using the ambrotype (a specific type of wet plate) and will determine ISO (photographic sensitivity to light) experimentally, as well as the nuances of working with the medium. This project will make use of a Cadmium Bromide, Ammonium Bromide and Potassium Iodide salted collodion.

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Artist's Statement

Wet plate collodion is almost 200 years old (Alexeev) and is inherently a complex process, photographically, and to a certain extent chemistry-wise. Aspects of the chemistry are very simple and others quite complex. The goal was to find a meeting place of the two things that I spent a great deal of my time here at Ball State doing–chemistry and photography.

The chemistry aspect can be really broken down into a couple main parts. It was a way to apply the scientific method–an integral part of any science education. It was a way to see the application of certain chemical principals that were largely only theory for me throughout my education. It is a relevant application of my chemistry knowledge to another field I find very interesting, and finally it is a way to utilize my lab skills that I have developed throughout my time here.

A large portion of this project was establishing baselines and standards for successfully shooting wet plates. As a result, I needed to make use of the scientific method in a sense. It was a system of trying and manipulating variables. Manipulating exposure time until the plate looked correctly exposed, scanning it and confirming it. Manipulating developing times until adequate shadow detail was retained.

Visualizing the theory learned in class was great. For example, sensitizing the plate is a simple concept of which concepts are introduced

as early as freshman chemistry. Silver halide salts (Cl, Br, I) are insoluble which in chemistry means not that it will not dissolve, but rather it will dissolve in low concentrations. For wet plate, this has to be taken into account. In fact, one of the steps in preparation of the sensitizing bath is to add the bromo-iodizer to allow the silver to precipitate out on the plate.

Furthermore, in analytical chemistry we talked about how silver salts actually degraded when exposed to light. I remember watching the salts we had for a titration slowly change color over the course of the lab period. This was an opportunity to see this in a more precise way. As well as explore the implications of this.

Almost every chemistry course has a lab portion. So I have had 4 years of laboratory experience in which I could apply to this. It not only helps with the risks but also a way to handle these somewhat dangerous reagents safely. It allowed me to keep my reagents clean and helped me create a meaningful conclusion with each plate. It also helped me understand where I could give less attention without compromising results and what contamination would affect what.

My chemistry knowledge allows me to say what each reagent and compound I have does and why it is important to the plate. As a result, I think I got more out of the shooting process by appreciating and understanding the chemistry of the wet plate.

The photography part is little more fluid. It gave me a way to use my photography knowledge garnered through classes and practice in a new and very different way, but largely it served as the motivating factor to continue this project.

The first part of this project was learning the process of large format. The goal was to make sure I was proficient in the mechanics so the only variable was the plate. In preparation of this I shot sheet film. I had shot film before and with a fair amount of regularity, but prior to this project had not shot large format. Having the previous experience of film allowed me to hammer down just the mechanics of the medium. I shot a box of 5x7 film, which is 25 shots. This also served as a way to check the camera for light leaks or anything else that would add a variable.

Over the course of this I learned a form of photography (large format) that really is not taught here outside the art department, but is still a viable medium used professionally and commercially today.

Ultimately though, this project was as a learning opportunity for a number of things. First, and most obviously, it was a way to learn how to shoot wet plates. Secondly, it was a way to learn the margin of error and how flexible wet plates are in terms of photographic techniques such as exposure and developing but also the preparation of said plates, and to a certain degree modern films. It was also served as a way to learn how to

prepare and process wet plates and thus attempt to grasp the birth of photography. It was also a way to learn the chemistry and science of photography in general.

Learning to shoot wet plates is not necessarily commercially viable, but it is making a resurgence. It will probably never be a dominant medium; the fidelity and lack of convenience do not make it great way to produce anything. It does have a unique aesthetic though.

More importantly though, the goal was to learn how flexible the plates are. In looking up information as a jumping off point, I had noticed that there was a great degree of variability in the information. The hope was, with some application of my chemistry knowledge, I would be able to refine this information and find the information or the causes of these variances.

Film for example has about 6 stops of dynamic range essentially 6 exposure brackets that would produce an image with something in it. If for an example you were photographing a scene with a two stop range although it would be technically correct to put the exposure in the middle of this range in theory 2-3 stops under or over optimal exposure would still yield a viable exposure.

Determining the dynamic range of wet plate will offer some insight as to the variability and perhaps a justification.

I ended up researching a lot about the chemistry of photography. To a certain extent, it is very simple. Most of the chemistry is over 200 years old and understood further back than that. It was interesting to learn how the fixer compound, the compound that removes the unexposed silver from the plate, made photography viable for the first time. The fact that silver salts were light sensitive was not the holdup in the development of photography was quite shocking to me.

It was important to be to learn about the early part of photography, because photography became and is such an integral part of my life.

For this project I used a specific salt blend to salt my collodion, specifically Cadmium Bromide, Ammonium Bromide and Potassium Iodide. This was for a number of reasons. First, the chemistry of the cation (the first part of each of these compounds) and its subsequent effect on the properties of the plate is an area of research too involved and beyond what I am capable of doing with my level of education and resources at hand. As a result, I went with these because they are known to produce a viable and useable plate once exposed. The other more important reason being that I could purchase these premixed commercially and affordably in the quantities I needed. To buy salts separately and with decent purity ran at a minimum order of about $100 per salt compound. The cost would quickly become prohibitive.

I shot a variation of wet plate known as the ambrotype. Which is plate prepared on glass and usually the back image of the plate is painted black after development to produce an image that looks like a positive. The reason I chose to shoot these comes down, once again, to two reasons–cost and logistics. I could affordably buy plate glass from a hardware store and have it easily cut to the sizes I needed. Logistically I like to scan negatives which would allow me to manually set black and white points for the plates, shooting them on glass allowed me to do this. Finally, there is no significant difference in the process between shooting glass or tin or anodized aluminum plates, aside from the addition of amino silane. This is a compound used to increase adhesion between glass and organic compounds (in this case the glass plate and collodion). The result is quite noticeable. I shot a comparison plate for reference.

It is important to note that there is a photographic process from about the same time period known as daguerreotypes, however this is a radically different process and relies on the use of silver sheets as a source of light sensitive medium. As it is not a derivative of wet plate, nor is it related in its chemical process, it was not explored.

I ended up using commercially available acidic developer and rapid fixer. First, because although the developing portion of wet plate is important it is not the aspect I was focusing on for this project so there is not a need to synthesize these solutions and compounds. Typically film

is developed in an extremely alkaline solution while as wet plate done in a typically acidic solution, which is why I chose the developer that I did. The fixer could have been anything. Its only job is to remove the undeveloped silver from the plate and all fixers are functionally about the same.

I ended up shooting the plates on a 5x7 view camera. When it comes to large format photography there are three fairly common sizes. 4x5 is the most common followed by 8x10 and then 5x7 being the least common. There are sizes larger than this but finding the cameras and the relevant accessories such as film holders and lenses is very difficult and thus were not considered. 8x10 is one of the more common sizes that people typically shoot wet plates on due to the low fidelity of the medium. 8x10, however, is expensive in almost all regards including the camera, film holders and lenses. 4x5 tends to be the most cost effective and, due to it being the standard camera for news photographers for many years, is readily available. It, however, would be small considering the relatively low fidelity of wet plate. As a result, I chose a 5x7, which has a cost comparable to 4x5 and is very cost effective due to using the same lenses as 4x5, which tends to be a major cost in the equipment aspect of the process.

For this project I chose to shoot all daylight photos for a number of reasons. The most notable being that it turns out that a majority of wet

plates sensitivity is in the UV range. I had tried starting with studio strobes as a light source. It turns out that the strobes do not have a high UV output and thus require a disproportionate amount of power. One figure I found said about 3700watt seconds is a starting point. This is not feasible here as it is ten times more output than the strobes I own and over six times more output than the school strobes here.

Certainly, it can be done, but was cost prohibitive for this project. The other reason being is that a traditional photographic light meter works best with the suns output of visible light in relation to its output of UV light. Furthermore, shooting wet plate in daylight is still the most prevalent and by far the easiest method, and thus conclusions based off of daytime exposures are the most useful.

Theoretically, any source with a decent UV output would suffice for making an exposure, however, going back to the point above, the light needs to have a proportional amount of visible light in order to meter the scene properly. So while as fluorescent bulbs, as well as UV black lights would work, not having a consistent enough output spectra with a proportional amount of UV light does not make them ideal light sources.

I chose to shoot still lifes. This helps with bracketing the exposure (going through a variety of exposures around where the ideal exposure should be, usually done in whole stop increments), as well being able to easily compare these bracketed exposures. Additionally, still lifes do not

move and with exposure times any where from a quarter second to upwards of two minutes the ability of the subject to remain still is imperative to a sharp image.

Shooting still lifes does produce one notable drawback, which is easily adjusted. When focusing with a bellows type system, such as what I am using for this project, if you are focusing on something relatively close to the camera and your bellows extension (distance from lens plane to image plane) exceeds that of the focal length of the lens (in this case 210mm) then a bellow extension factor must be taken into account. This is because once you go beyond the focal length of the lens, there is less light on the image plane. (Modern macro lenses for 35mm film or digital equivalents actually do the same thing but take this into account automatically.) The calculation is semi-logarithmic due to the photographic exposures system, but there are commercially available calculators and free online ones. I chose to do it long hand, as the formula is relatively straight-forward. It is Compensation factor $=\log_2 ((\text{extention}^2)/(\text{focal length}^2))$. It is important to note that it is log base 2 and not base 10, which is the base factor for most calculators.

My subject choices tried to establish image characteristics whenever possible. For example, the cameras still life was an exploration of dynamic range but also how the image would handle the specularity of the shiny metal top casings. The white cup is tonal values and so forth. I

tried whenever possible to still create aesthetically pleasing images, just because the plates had to be useful did not mean they themselves could not be good images. Additionally, shooting a subject helps to determine whether or not the image was successful. For example, an unexposed plate developed at an extended period of time could look like a properly exposed gray wall. So being able to see an image acts as a check on the success of the plate. Because, when it comes down to it, chemically there is a variety of ways to achieve a plate that is even across the plate in tone, but is not an actual image of anything. There are a couple sample plates of this. Including an essentially unexposed plate that has been overdeveloped.

My modification of a film holder is slightly non-standard. There is no real reason, or advantage to this modification. I chose to modify mine to load like sheet film does, which is in tracks essentially on either side of the frame, making changes to accommodate the thicker profile. The standard holder for wet plate tends to bind the plate in the four corners using wire. The standard method preserves the edges of the collodion and keeps it from shifting around. My method can be done with fewer tools and is more akin to the practices of loading large format film.

Ultimately though, as mentioned above, this was a project to explore a process that was at the birth of photography. It was a way to put the theory of it all to the test. Certainly, the wet plate has a unique

aesthetic; and for this reason is likely why it is seeing a resurgence. Though, since digital technology has gotten so good, in some regards better than film ever was, there has been a trend in pop culture to head back towards lower fidelity images. While as this project was not about that, the movement certainly helped with being able to get a lot of the necessary supplies as they are commercially being produced, it also allowed me to do so at a much more reasonable cost than having to go through a commercial chemical provider. This made this project feasible and it likely would not have happened if not for this trend, just out of the cost barriers that would have existed.

Wet Plate Cookbook

Directions adapted from Bostick and Sullivan's Wet Plate Instructions. All steps should be done with caution and with proper safety precautions including protective eyewear and ample ventilation.

Reagents (all ordered from Bostick and Sullivan)

USP Collodion

Old Workhorse Bromo-Iodizer

10% Silver Nitrate

7% Nitric Acid

1% Iodine Tincture

Amino Silane

Ferrous Sulfate developer

B&S Rabid Fixer

Mixing the collodion

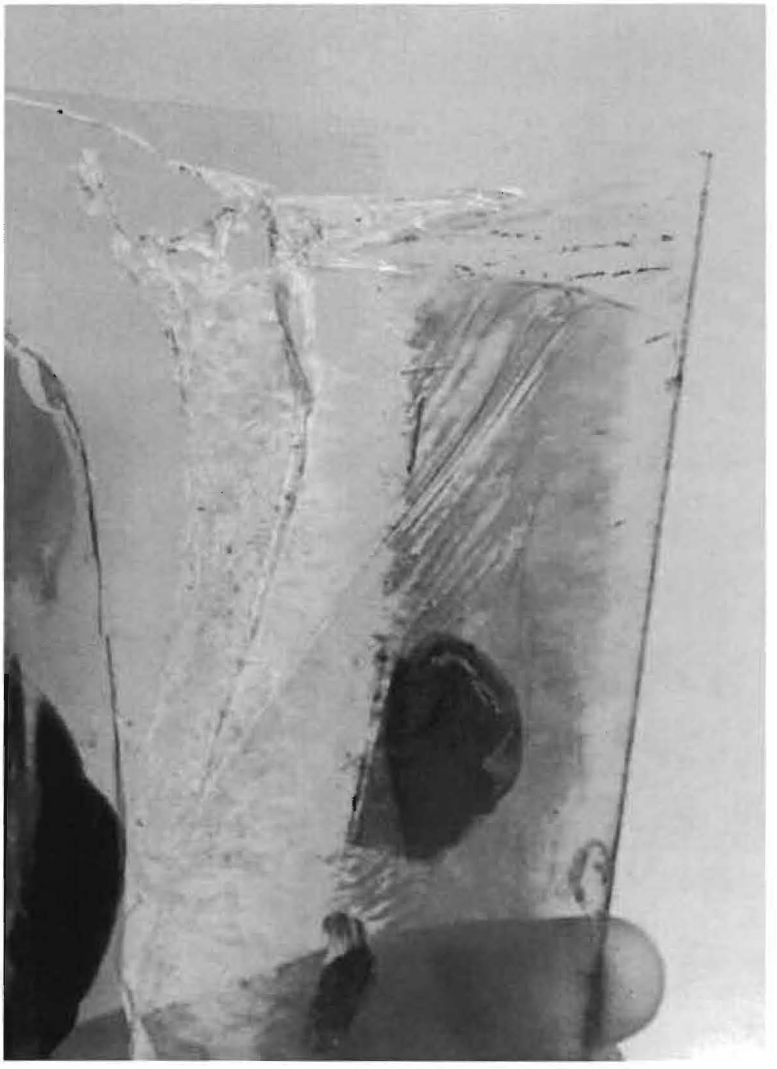
The collodion should be mixed 5:8 collodion to Bromo-Iodizer, with 3-5 percent amino silane added. The silano compound is essential for glass, but can be skipped for tin or metals. I found it is difficult to add too much, though I would hesitate to exceed 5%. It is important to note that the halide solution is in an organic solvent and thus does not have a high surface tension making it difficult to pipette without prior experience. I would mix in a batch of sufficient size to facilitate pouring.

A few drops of the Iodine tincture may be added per 100mL at this step as a contrast boost if so desired. I would recommend shooting plates without it first and if so desired adding it to the collodion after one grasps the look of the collodion. The collodion after mixing is ready to use though I aged mine over about 12-18 hours. If stored properly in a dark and temperature controlled room, results will remain more consistent.

Preparing the sensitizing bath

The silver solution provided can be used immediately however it is helpful to add a certain amount of nitric acid to help stabilize the bath long term. The silver solution I had started out at a pH of 5 and I added Nitric acid drop-wise until it was about 4-4.5. A small amount of Bromo-Iodizer should be added to the silver bath to ensure that the halides are not leached off the plate. It is recommended 4-5 drops per 1000mL. You have a bit more of a window here and the solution can be added drop-wise until a drop forms a white precipitate in the solution, in which you should stop immediately. Another option, the more traditional option, is to prepare a plate and let it soak in the sensitizing bath overnight. It is important at this stage to note the specific gravity of the sensitizing bath using a hydrometer. This will become the baseline for maintenance. If so desired, mixing small batches may skip a great deal of maintenance and using them rapidly and disposing once results become inconsistent. This,

however, will become the more costly option. Regardless, the bath should be filtered semi-consistently if clean plates are desired.



Lack of Amino Silane causes poor collodion adhesion to glass.

Preparing the developer and fixer

Mix the developer with water 1:1 or 1:3. Both work sufficiently well without a radical change to development times. Distilled water is recommended but not required.

The fixer should be mixed 1:3 with water. If an alternative rapid fixer is used, follow their directions. Once again, distilled water is recommended, but not required.

Preparing the plate

A large portion of the halogenated collodion should be poured on the center of the plate. The plate should then be tilted to work the collodion to all corners of the plate. The surface tension of the collodion gives you a fair amount of room to not spill it over the edges of the plate. The excess collodion can be drained from a corner. In this step it is helpful to add an excess of collodion and drain it off at the end. Adding more collodion after the initial pour will not yield a satisfactory results and the uneven coat will be reflected in the final plate.

The collodion coated plate can be put directly into the sensitizing bath, however I found that if give 30-60 seconds to thicken, there were less issues with peeling of the collodion once introduced into the bath.

The plate can be put into a sensitizing bath for 3 minutes. This time may be manipulated as long as the coating after the sensitizing is white and sufficiently dense. Too short, however, and there is a risk of not precipitating out enough silver and too long there is a risk of leaching compounds off the plate. 3 minutes I found was a good consistent baseline that left more than ample silver on the plates.

Shooting the plate

Allow the plate to drip for a few seconds. Not required but prevents mess as Silver Nitrate stains most things irreversibly. Load it into a plate carrier. The whole assembly may be loaded into a camera and shot.

Daylight is recommended and direct sun will be the easiest to meter. Using a standard light meter, in the sun, the exposure can be metered at about a .5 ISO (ASA). From my experience, the reciprocity failure of this setup is relatively substantial. That is to say that at equivalent exposure values, exposure times do not matched theoretical values. As a result, I find as exposures approach one minute at .5 ISO the exposure should be metered at a .25 ISO and thus converted to two minutes..

Photographic strobes have not proven useful due to their low UV output. Metering at the correct ISO will not yield an image and a disproportionate amount of power output would be required.

I have also found that the dynamic range that the plate is able to produce is not very high. As a result, contrast should be controlled across the scene to capture as much tonal detail as possible. For this reason it may be helpful to bracket exposures to make sure the portion of the scene that is important is correctly exposed.

Developing and fixing

Development times are about 30 seconds. Since the plate has a relatively low sensitivity the plate can be developed and fixed while being exposed to a dark room bulb. The best way to develop wet plates is to watch the development take place as cut it off just as your shadows start to develop.

The development can be stopped using water though functionally adding it directly to the fixer works just as well. I used a 5 minute fix. In theory if the plate is left too long in the fixer it will start to pull off the exposed silver.

The plate should then be rinsed anywhere from 3-7 minutes. Long enough to remove any left over fixer, but also to dislodge loose silver pieces that were formed during the fixing and developing process.

Finishing the plate

The plate should be allowed to dry completely before handling. The collodion will remain brittle and relatively fragile. Varnishing the plate is standard. If the plate was shot on glass, the back of the plate may be painted black in true ambrotype fashion. This creates the illusion of a positive.

Example of black painted backside (true ambrotype)

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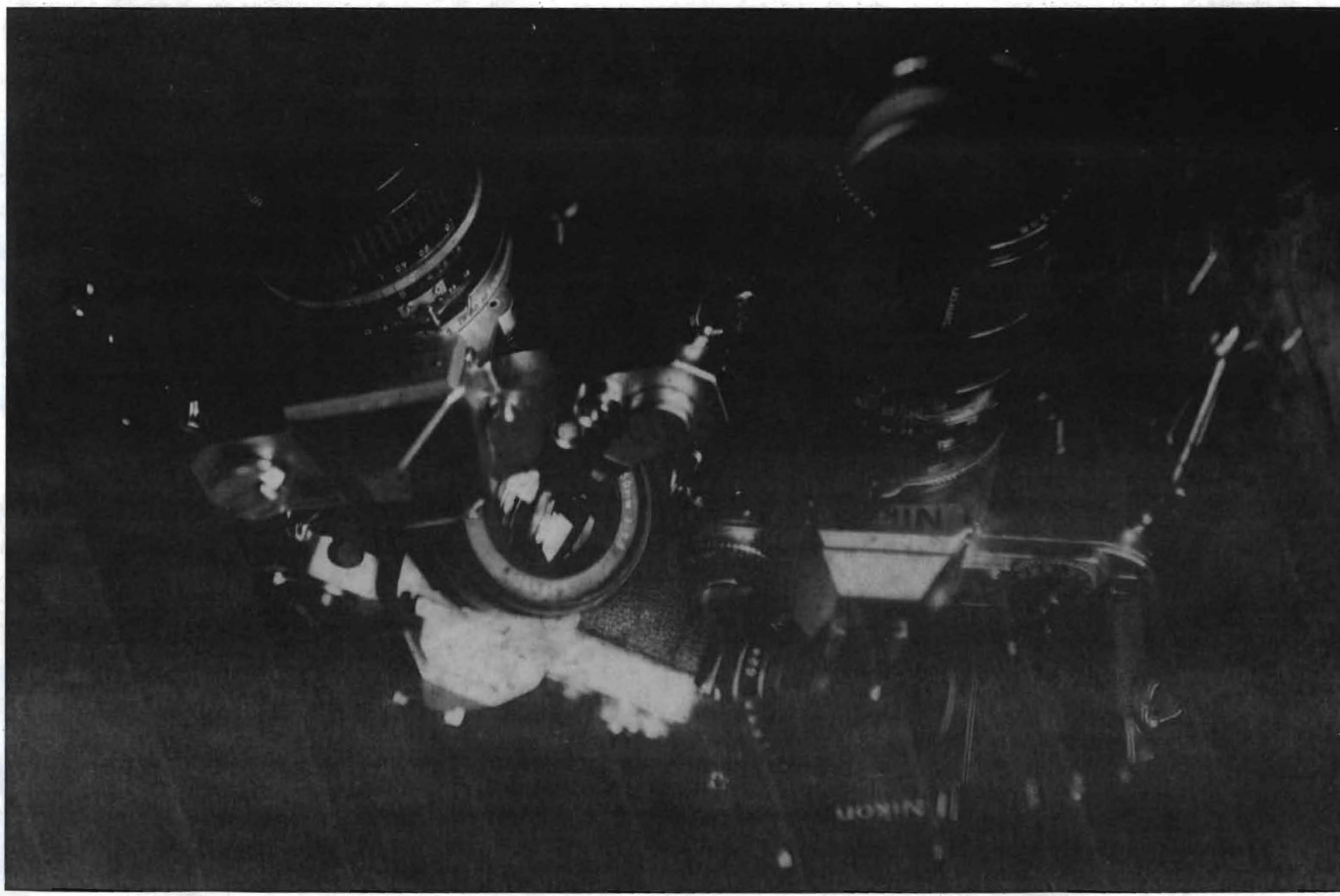


Attempted stroke exposure


over developed